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INSECT LIFE IN POND AND
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THE HOME OF THE WATER INSECTS

The book cover features a decorative border. At the top corners are two detailed illustrations of butterflies. The central part of the cover is framed by two large, stylized flowers with long, slender leaves. At the bottom corners are two caterpillars. The text is arranged within this decorative frame.

WONDERS OF INSECT LIFE

F·MARTIN·DUNCAN·F.R.M.S. & F.R.P.S.
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INSECT LIFE IN POND AND STREAM

LONDON
HENRY · FROWDE
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CHAPTER I

LIFE IN POND AND STREAM

IF you have read "Water Babies" (and I hope you have), you will remember when the poor little sweep's boy, Tom, ran away from his cruel master he came at last to a bubbling brook. And there he slipped out of his old black skin, tumbled himself into the brook, and sank down, down in the clear, cool water, and turned into a Water Baby only four inches long. Under the water Tom lived for many a day, learning how to behave himself; and he had the most wonderful adventures, and met with all sorts of surprising creatures, as he wandered along in the streams and the river on his way down to the sea.

Now the best part of this story is, that all those strange creatures do really live under the water; and if you could follow Tom's example and turn into a Water Baby four inches long, you would meet just exactly the

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same quaint water folk as he did, moving about in the ponds and streams to-day.

For every winding river, every rippling stream, and every silent pool is a complete water-world, the home of many a strange or interesting creature. We know, of course, that all sorts of fishes live in fresh water, from the lordly salmon and silver trout to tiny minnows and sticklebacks; water voles make their home in the banks of the streams and rivers, and the shy coot and moorhen hide their nests amongst the rushes.

But there are other water-folk besides the fishes, the birds, and the water voles. If we look down into the water we shall see all sorts of curious little things swimming, diving, and bobbing about, while down at the bottom of the pond many queer-looking creatures are moving, creeping over the stones and mud, and climbing about the water weeds.

There goes a strange-looking object, just like a cigar fitted with tiny legs and a queer-shaped head. There, a little bundle of bits of leaves and odds and ends of stick and straw, suddenly puts forth a round head and six spidery legs and starts slowly marching along. And there two sausage-shaped

creatures, with large flat heads and hook-like jaws, are rolling over together and biting each other for all they are worth !

What are all these peculiar creatures ? Insects, you say ? Yes, these funny-looking things are water insects,—strange members of the insect world that make their home beneath the water. They are not a special kind of insect ; they belong to several different insect families, and most of them have relations on the land which would quickly drown if they fell into the water. Some water insects live all their lives in ponds or streams ; others, strange to say, spend the first part of their lives, while they are grubs, or larvæ, in the water, and the latter part, when they have become perfect insects, flying about in the air. From ugly grubs they are changed to beautiful winged creatures, reminding us of the enchanted frogs and toads of our fairy tales, which became transformed into princes and princesses.

It certainly does seem strange that many a gauzy-winged fly, which would be drowned almost at once if you held it beneath the water, has lived quite safely and comfortably there in its early days (almost as strange as

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if a fish suddenly took to itself wings and flew away as a bird), but then we must remember that insects are very peculiar creatures, which, as a general rule, entirely alter their way of



SMALL WATER-BEETLES.

life after they have gone through their wonderful transformations and become perfect insects. We know that many insects spend the first part of their existence buried in the ground, or inside plants, trees, or rotten wood,

so after all it is not so very astonishing that others should live for a while in the water.

There is hardly any kind of water in which some insects may not be found. Fresh water, salt water, pure water, stagnant water, hot springs, and icy water, all have their insect

dwellers. Not very many live in salt water, or in very great depths, but there are some little beetles which live so low down on the sea-shore that they are covered by the sea every time the tide rolls in, and some strange grubs that are perfectly at home in brine pits. Some insects like the bustle and excitement of running water, a few are even found in mountain torrents and cascades ; but most of these little creatures prefer still, or gently rippling water ; and a quiet, rather shallow pool, where reeds and rushes grow, and duck weed spreads its soft green mantle over the surface, is perhaps the best place of all to look for these quaint and interesting little water folk.

Almost all the year round we may find insect life in the ponds and streams. Even in winter, on a warm sunny day, we may see parties of gnats disporting themselves in sheltered nooks by the side of the water, and although most water insects sleep the cold days away buried in the mud at the bottom of the pond, if we look down into the water we are almost sure to see some that are swimming about or slowly moving over the water-weeds.

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But the best time to visit the pool is in the spring-time when all the reeds and rushes are fresh and green, and the banks are gay with golden kingcups, and the water iris unfurls its yellow flags ; or later, in early summer, when blue forget-me-nots nod their starry faces over the water and the water-crowfoot spangles the pool with its snowy blossoms.

For the wee insect folk love warmth and sunshine, and as soon as cold winter has passed they are all astir. Every sunny day brings out clouds of airy, gauzy-winged flies to dance merrily round the pool—far too many to please us indeed, for they leave their dance to settle on our hands and faces, and announce their arrival by sharp little stabs. Great, glittering dragon-flies hawk backwards and forwards over the pool, pouncing every now and then on one of the dancing flies and carrying it off in triumph. And if we look down into the water we shall see ever so many quaint little creatures, crawling about the weeds and stones, swimming through the water, or lightly skimming over the surface of the pond.

CHAPTER II

WEE WATER FOLK

BOBBING about on the top of the water is a tiny oval-shaped creature, about a quarter of an inch long, dressed in a shiny, blue-black coat. He darts about so swiftly that it is not easy to see what he is like, then suddenly he spins round and round in a circle, so fast, one would think the funny little thing must be dreadfully giddy. This is the little Whirligig beetle, and if you try to catch him so that you may have a good look at him, down he dives to the bottom of the pool and clings with his front pair of legs to a weed growing under the water. But he does not care to stay long below; his beat is at the top of the water, so he very soon comes up again and begins whirling round and round as fast as ever.



THE WHIRLIGIG BEETLE.

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Although he is so agile when at home in the pool, the Whirligig beetle is a clumsy little fellow on dry ground. If you take him out of the water he flops about and shuffles along in a most ungainly way. His legs are formed for swimming, not for taking walking exercise. The two hind pair of legs are perfect little paddles—broad and flat and fringed with long stiff hairs; these the little beetle uses when paddling his way through the water. The front pair of legs are much longer, but not so broad, and have many tiny suckers at the tips; with these the Whirligig clings tightly to the water weeds when he is tired of whirling and dashing about, and feels inclined for a little rest.

His eyes are most surprising; you would think at first sight that the queer little fellow had *four* eyes. For each eye is divided into two parts, by a kind of partition, one looking upwards and one looking down; so he is able to keep a sharp look-out above and below at the same time. If a hungry fish rises to snap at the little Whirligig he shoots rapidly away or spins round and round to confuse his enemy; and if danger threatens him from above, down he dives to the bottom of the



A DRAGON-FLY AT REST

[See Page 49.]



MR. AND MRS. BROWN WATER BEETLE

[See Page 27.]

pond and stays there until all is safe again.

Although he is a water insect this little beetle does not breathe as fishes do. He cannot extract the oxygen from the water, but has to obtain his supply from the air above. So when he dives below he carries with him a bubble of air, between the tips of his wing cases, which glitters like a tiny ball of quicksilver.

Although Mr Whirligig is not a good walker, he has a fine pair of gauzy wings tucked away under his hard, polished wing cases, and can fly as well as any land beetle. He is not able to spring straight out of the water, like a flying fish, so when he feels inclined for a flight he first climbs a little way up the stem of a water plant, then slowly opens his wing cases, unfurls his gauzy wings, and away he goes!

As he flies through the air the Whirligig hums like a bee; and before starting off on his journey he usually makes a funny squeaking noise, by rubbing the edges of his wing cases against a hard ring on his body, to let the other beetles know he is coming.

In the spring-time only one or two Whirligigs are to be seen. They are last year's beetles

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who have passed the winter months asleep in the mud at the bottom of the pool. But towards the end of summer crowds of little Whirligigs appear, all playing their favourite game of "here we go round the mulberry bush" so cleverly, that however fast they whirl they never bump into one another.

The Whirligig larva is a funny little thing, long and very thin with an extremely tiny head. It looks just like a centipede, for it appears to have a leg on every one of its body rings. The first three pairs are true legs, but the others are really breathing tubes or gills, through which the little creature extracts the oxygen from the water; for while it is a larva the Whirligig lives below, and does not draw its supply of air from above, as the grown-up beetles do.

It is a most active, and very hungry, little animal, always chasing tiny insects and gobbling them up; and if another water creature turns the tables on the little Whirligig larva and tries to catch it, it skips and hops about in the most surprising manner. Under its tail the larva has four tiny hooks which act as a spring, enabling the wee creature to jump about with great agility.

Towards the end of summer the larva climbs up the stem of a plant until it is above the water, and there it spins itself a tiny grey cocoon, but it is so well hidden amongst the grasses that very few have ever seen it. It sleeps soundly for a week or two, and then the cocoon opens and out pops a perfect little Whirligig beetle which slips into the water and at once begins spinning round like a top.

These little beetles like gently running water best, but in almost every pool and pond that is clean and clear we may find one or two of these odd little Whirligigs.

The Water-boatman, another quaint water insect, prefers still water, and is not at all particular about its being clean and pure, indeed, if possible he always chooses a stagnant pond or even a ditch in which to make his home.

The little Water-boatman is not much more than half an inch long, and has the strange habit of swimming upside down. His body is just the shape of a boat, quite flat underneath and rounded like the keel of a boat on the top ; so the boatman turns himself over on his back, and using his long hind legs as oars, he rows himself about with the greatest ease.

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Under his wing-cases the boatman wears a velvety coat, and quantities of tiny air bubbles become entangled in the short, soft hairs, so that he is entirely enclosed in a glittering film of air. This makes the boatman so light and

buoyant that he has much difficulty in keeping down under the water. When below he anchors himself with his short, front legs to a weed or a stone, and directly he lets go his hold, up he shoots, like a cork, to the top of the water again.



THE WATER-BOATMAN.

He is a very fierce and hungry little gentleman, and

attacks and devours all sorts of water creatures with his short, sharp beak; he will even eat one of his own relations without any ceremony. So courageous is he that he often kills insects much larger than himself, and should you be quick enough to catch one of these little Water-boatmen, he will most

probably at once stick his beak into your hand.

Some people say that these funny little insects make a queer little noise, which sounds like "chew-chew-chew," by rubbing their hands (or their front legs) together. I have never heard this noise myself, but this may possibly be because I have not happened to be passing by when a little Water-boatman is performing in this way, and so many insects are able to make sounds of different kinds that I have no doubt this little pond-dweller can say "chew - chew - chew" if he pleases. A big Water-boatman living in the shallow lakes of Mexico is supposed to be even more highly accomplished than his small British cousin, for it is said that he can play a tune on his snout by beating on it with his two front legs, just as if he were beating a drum !



THE GREAT WATER-BOATMAN.

CHAPTER III

SOME ODD INSECTS

IF you watch the surface of a pond very carefully you may often see something that looks like a tiny bit of stick, no thicker than a needle, floating on the water. Look closer and you will see that this "stick" has six legs as fine as hairs, and is not floating but *walking* on the top of the pond.



A WATER STICK-INSECT.

This is the "Water Stick-insect," and a very strange insect it is to be sure. It has a long thin head and a long thin body, and where one ends and the other begins is really difficult to tell, for it is just about the same thickness all the way up.

This peculiar insect spends its time creeping slowly about on the top of the water, on the look-out for the little dead insects which often float on the surface of the pond. On these the Water Stick-insect feeds,

though how such a very thin creature can eat at all seems really a puzzle.

This insect is sometimes called the "Water-measurer," because as it creeps over the surface of the pond it looks just as if it were measuring the water with its long, thin legs.

The Pond-skaters are very like the Stick-insects, but their heads are not quite so long, and



A POND-SKATER.

they are not quite so thin. They have exceedingly long legs though, and are much more lively than the slow-going Water Stick-insects. Instead of creeping slowly about, the Pond-skaters skim along the top of the water at a very great rate, or skip and jump about in the most amusing manner. They patter over the surface of the pond just as if it was dry land, and do not even wet their tiny feet.

How is it, do you think, that these strange

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insects manage to walk so easily on the top of the water, and never get wet or sink down to the bottom of the pond?

It is because the surface of the water is always covered with a kind of elastic skin, called the "surface-film." It is very, very thin, and quite invisible, but it is strong enough to bear the weight of many tiny creatures. As the Pond-skaters run over the surface-film their feet make little dents in it, but do not sink through. If you watch the little insects darting about on the top of a clear, shallow pool when the sun is shining, you will see the shadows of these tiny dents on the sandy bottom of the pool.

The Pond-skaters are rather timid little things, and although they live on other small insects they generally content themselves with dead ones and seldom hunt for living prey. When they are not skating about looking for something to eat, these funny creatures are generally very busy brushing their legs and cleaning themselves up, for they are most particular, tidy insects. Their heads, their bodies, and even their long, thin legs are closely covered with a short velvet pile, so even if they venture beneath the surface-film, and

they can, and do, dive sometimes, they never get wet. But the Pond-skaters much prefer skating on the top of the water, and very seldom go below ; though one of these long-legged water folk is sometimes seen running upside down on the surface-film, just as a fly walks on the ceiling. Of course he is then right in the water, but his velvet coat keeps him dry ; and he carries an air-bubble at the end of his tail, so that he may breathe comfortably while he is below the surface.

These peaceful little insects have some near relations which lead a far more exciting life. They are great travellers, and are often seen right out in mid-ocean calmly running about on the top of the sea.

There are some other little insects, called "Spring-tails," that live on the top of the water, too. If these tiny things went about singly you would probably not notice them at all, as they are only one-twelfth of an inch long ; but they are friendly little creatures, fond of company, and in the summer months they go about in large parties on ponds and ditches, all skipping and springing about like a lot of little sand-hoppers. They are black, except just after they have moulted, which

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they do very often, then they are quite white. So every party of these cheerful little creatures contains some black and some white ones.

The Spring-tail has gained its name from the funny way it has of tucking its tail under its body and then letting it spring back with a sudden jerk, which sends the little insect bouncing up into the air like a ball. It is so small and light that it cannot possibly sink through the surface-film, no matter how it may hop and bound about.

When the days become cold and food is scarce, the Spring-tails go below and bury themselves in the mud at the bottom of the pond; and the only way they can manage to get beneath the surface film is by grasping the stems of the water weeds and regularly *pushing* themselves through. They never get wet even when right under water, for they carry with them quantities of minute air-bubbles entangled in the short, thick hair with which they are covered. So each little Spring-tail is completely enclosed in a glistening coat of air.

But I fear the water world is a dangerous place for little Spring-tails and other wee water-dwellers. At the top of the pools

many an enemy is on the watch to snap up small and helpless creatures, while below lurk terrible monsters ready to clutch and devour them directly they venture beneath the surface. At the bottom of the pool, prowling slowly about in search of prey, is the Water-scorpion. An ugly-looking creature, broad and flat, and a dull ashy-brown colour. It appears to have only two pairs of legs, as it holds up its front pair as a crab does its great claws, ready to seize any unfortunate little animal that comes within its reach. These curious legs can be folded in two like a clasp-knife, and when once they close on a victim they never let go until the poor thing has been sucked dry by the Scorpion's cruel beak.



THE WATER-SCORPION.

This ferocious insect is about an inch long. It is a dingy-red colour, but its back is covered by dull ashy-brown wing-cases ; so you cannot see that it is red unless it turns on its back,

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or opens its wing-cases and spreads its wings to fly away. At the end of its body are two long, hollowed spines, that fit together to make a breathing tube which looks like a funny long



THIN WATER-SCORPIONS.

tail; and when the insect needs a fresh supply of air it creeps slowly backwards up the stem of a water-weed and pushes the tip of this queer tail above the surface of the water.

Another Water-scorpion is often to be seen creeping over the weeds or skimming along on the top of the water. It does not look in the least like its cousin who lives at the bottom of the pool, for it is as long and thin as a Pond-skater. But both the Broad Scorpion

and the Thin Scorpion hold up their front legs in the same crab-like manner, and by this peculiarity we can tell they are relations.

CHAPTER IV

THE TYRANT OF THE POOL

Who is this fine, big fellow swimming so quickly and strongly across the pool? Let all little Whirligigs and other small fry beware, for this is the great Brown Water-beetle—the Tyrant of the Pool.

He wears a coat of chestnut brown, so dark as to look almost black in the water, bordered with a narrow yellow line, and his wrists are adorned with a fine pair of frills.

A mighty hunter is the Brown Water-beetle, feared by all the dwellers in the pool, who flee in terror from before him. And small wonder they do, for this beetle is so fierce and strong that few can escape him. He is over an inch long, and is armed with a strong pair of toothed jaws with which he is always ready to attack any creature that comes in his way, while he himself is so well protected

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by his hard, armoured coat that he is not afraid of anyone who lives in the pool, however big they may be.

This fierce beetle is really a most accomplished person; he can walk, climb, swim and fly with the greatest ease. His legs are really



FRONT LEG OF BROWN
WATER-BEETLE.

remarkable, each pair being entirely different from the others. On his front pair of legs the beetle has curious frills covered with tiny suckers, these are used for clasping and holding fast many a slippery victim. The second pair are long and end in strong hooked claws; with these Mr Beetle walks about, or climbs

up the plants growing in the pool. The third pair are broad and flat, and fringed all round with stout hairs, and these serve the beetle as oars with which to row himself swiftly about in the water. Mrs Brown has no frills on her wrists, and her wing-cases are furrowed instead of being smooth and polished, so you might

easily imagine she was a different kind of beetle.

Nothing is safe from this Tyrant of the Pool. He attacks insects, tadpoles, newts, snails, worms and little fishes. He is a cannibal, too, and thinks nothing of making a meal of one of his own relations ; two Brown Beetles will sometimes have a terrific fight, and when the weaker of the two is killed the victor will proceed to eat him.

When he has done as much mischief as he can in one pool, the Brown Water-beetle will come out of the water and fly off to another one. He chooses the evening time for his flight, climbs up the stem of a tall water plant, unfurls his gauzy wings, and starts off in quest of fresh hunting-ground. Sometimes, however, the beetle comes to grief on these expeditions, for he is not always careful to look where he is going, and he has been known to mistake the glass roof of a green house for a pool of water and comes hustling down on the top of it with a tremendous thud ! He must be very much surprised, I should think, to find the water so hard. Perhaps he thinks winter has come and the " pond " is frozen over.

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This great, strong beetle is a wary fellow, and if he sees you are watching him he will dive to the bottom of the pool at once, and there he will stay, clinging tightly to the weeds, or fixed by his suckers to a stone, until he thinks all danger has passed. He does not



SECOND LEG OF BROWN
WATER BEETLE.

care to stay too long below, indeed he could not live altogether under the water, for he breathes in true insect fashion through breathing pores (or spiracles) placed down each side of his body, protected from the water by his tightly-fitting wing cases, and cannot draw his supply of oxygen from

the water as fishes and most water creatures do.

So when Mr Beetle dives below or swims through the water he always carries a little store of air about with him in a water-tight compartment between his back and his wing case. The wing cases curve slightly, and fit

very closely together, keeping the air in and the water out.

When the oxygen in his little air-tanks becomes exhausted, the beetle rises to the surface, sticks his tail out of the water, and takes in a fresh supply. He opens his wing cases a little way, and the air clings to his hairy coat, forming a large, flat bubble on his back. Then when he has filled his tank, he closes his wing cases and darts away, feeling much refreshed.

In his early days this Brown beetle is just as much a tyrant of the pool as when he is a grown-up perfect insect—and an ugly, ill-conditioned young grub he is to be sure. When full grown he is over two inches long and a dirty-looking, yellowish-brown colour. His body is long and clumsy, thick in the middle, but tapering towards the head and tail. His head is large and flat and almost round in shape, and is joined to his shoulders by a



THIRD LEG OF BROWN
WATER-BEETLE.

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short neck, so that he can twist it about in all directions. This ugly grub is a perfect terror to the more peaceful dwellers in the pool, for his head is armed with a most formidable pair of jaws, long and curved and pointed at the tips, and he is always ready to use them, too, on any unfortunate creature he can catch unawares.

Nothing in the pool is safe from this cruel, Brown beetle grub. He goes about killing and devouring every small creature that comes in his way. He clutches the water insects with his hooked feet, and sucks their blood through the tips of his hollow jaws ; he pulls the snails from their shells ; drags the worms from the mud ; and sticks his fangs into the pretty little stickleback as they go merrily swimming by. He is a quarrelsome fellow, too, and should he meet with one of his own relations he at once begins a fight, and the two ugly grubs struggle and roll about together, biting and tearing each other with their jaws until one is killed ; and then the victor calmly eats his conquered opponent !

Sometimes this beetle grub swims lazily about in the water, rowing itself slowly along with its six little fringed legs, but all the while

it is keeping a sharp look-out for prey. As soon as it spies a victim the grub springs through the water, curving its body like a snake. At other times it creeps about on the floor of the pool, or lurks amongst the thickets of weeds and grasses beneath the water, like a tiger in its lair, pouncing out and seizing any little animal that passes by.

At intervals the grub comes up to the top of the water to take in a fresh supply of air. At the end of its tail it carries two breathing tubes which it pushes above the surface-film when it wants to breathe. The grub is lighter than the water, so when it wishes to come up to the top it has only to release its hold on the weeds, or stop swimming, and it floats to the surface, tail first.

But at last the Tyrant gives up its wicked ways and rests for a time as a pupa. It crawls out of the water and buries itself in the soft mud at the edge of the pool. If it is summer-time its sleep lasts only for a fortnight or so ; but if it is late in the autumn the larva buries itself more deeply in the bank and rests quietly in its little cave all through the cold weather, and does not turn to a pupa until the following spring. Then in a week or two

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its change is complete, and the Brown Water-beetle creeps forth from its underground cell.

Now for a few days our friend must be very cautious. He must hide himself carefully amongst the weeds and grasses. For when he first creeps out from the bank he is very feeble ; his coat is pale and quite soft, and if any prowling creature finds him it may take its revenge on the tyrannical beetle, who is much too weak to defend himself. But after a week has passed the beetle regains his strength, his coat darkens, and gradually grows hard and polished. So our beetle grows fearless, and comes boldly forth from his hiding-place—ready once more to be the Tyrant of the pool.

The Brown Water-beetle may live for two or three years if no accident befalls him. In the winter he goes to sleep buried in the mud at the bottom of the pool, but he wakes up sometimes when the weather is mild and takes a little exercise swimming round the pool.

I should advise you to be careful how you handle a Brown Water-beetle, for when it finds itself captured it will often spurt out an evil-smelling, milky fluid from behind its head. The little Whirligig beetle behaves in

much the same unpleasant way, jerking out a milky fluid (which has a scent that reminds one of Cockroaches) from nearly all its joints directly it is seized.

CHAPTER V

WATER BEETLES GREAT AND SMALL

IN many a weed-grown shallow pool we may find the "Great Water-beetle." He is a splendid fellow, dressed in a dark olive-green coat, marked with faint lines and dots, and is not far short of two inches long—nearly as big as the Stag beetle, which is the largest beetle we have in England.

Although he is much the larger of the two, the Great Water-beetle is no match for the Tyrant of the pool, who often attacks and kills his great neighbour. For in spite of his great size the Great Water-beetle is a peaceful and rather slow-going creature, with very little power of defending himself against the onslaught of the savage monsters of the pool. He swims slowly along in a jerky way through the water, for his legs are not particularly

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powerful, or rests clinging tightly to the water plants.

In fact, the Great Water-beetle is just a placid, mild-tempered giant. He does not



THE GREAT WATER-BEETLE.

want to fight, or hunt the smaller dwellers of the pool, but is content with a vegetable diet of leaves and grasses — only occasionally snatching a passing insect by way of a change.

He behaves quite differently from the Brown Water-beetle when he comes to the surface for a fresh supply of air. The Great Water-

beetle rises head first, and instead of sticking his tail out of the water he turns over on one side and slightly bends his head to open a little cleft between his head and shoulders; at the same time he curves one of his feelers backwards to form a little funnel through which the air is sucked down. Soon the under surface of the beetle is covered with a film of air which glistens like silver in the water, and he carries this with him so that he may breathe comfortably when he dives below.

Although the Great Water-beetle is not a very strong swimmer, he has a fine pair of wings folded under his wing cases and is able to fly very well, and at night he often leaves the pool and takes a little exercise in the open air.

Although Mr Great Water-beetle is not a particularly interesting insect, Mrs Beetle is most clever and industrious, and she makes a really beautiful little water-tight cocoon in which to place her eggs, so that they may ride safely on the water until the baby grubs hatch out.

When ready to begin her work Mother Beetle rises to the top of the pool, turns over on her back and clings with her hind legs to

some floating weed. Then she begins to spin a fine silken thread with a little spinning machine, called a spinneret, which she has at the end of her body, just as a spider has. With this silk Mother Beetle gradually weaves her little cocoon, carefully pressing and shaping it with her fore-legs as it grows.

She works away steadily for some time, but at last the tiny silken bag is finished, and in it she places about fifty or sixty little pointed eggs. When this is done Mother Beetle carefully closes the mouth of the bag, weaving the ends firmly together with silk, for it is most important that the precious eggs shall not get wet, and the cocoon is so strongly and beautifully made that no water can get inside. It is filled, too, with air, and floats on the top of the water like a little boat.

But Mother Beetle has not quite finished her work yet: as a finishing touch she adds a tiny mast or funnel to the little boat, which stands upright at one end. Some beetles anchor their cocoons to the water-weeds with a silken rope, but others let them float away and drift here and there on the top of the water.

The tiny boat floats on the water for two or three weeks; it is so well balanced that it never

capsizes ; and then the little larvæ hatch and make their escape into the water.

Now wouldn't you think the children of these peaceful Water-beetles would be gentle, well-behaved little grubs ? But, oh dear no ! They are just as wicked as they can be, and are almost as much dreaded by the inhabitants of the pool as the bold, fierce larva of the Brown Water-beetle. They are not content to browse quietly on the water weeds as their parents do, but kill and devour all the little water-folk they can manage to catch ; and if the supply of food is not very plentiful, they think nothing of eating each other !

They are ugly-looking things too. When first they leave their little boat they are mouse-coloured, and of course very tiny ; but, strange to say, before they have taken any food, these odd little grubs at once puff themselves out until they are three or four times as big as when they popped out of their egg cases. When full grown they are great fat things, quite three inches long, with thick, soft, soot-coloured bodies, but their heads and shoulders are hard and a shiny reddish-brown. Whether they are resting or creeping over the floor of the pool, these ugly

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grubs have a funny way of turning up their heads and their tails; and by this strange habit you may always know the larvæ of the Great Water-beetle.

In the spring-time and early summer in nearly every shallow pool, covered with a soft green carpet of duckweed, we are sure to find numbers of the "Small Water-beetle" clinging to the weeds or darting swiftly about in the water.

They are rather pretty little beetles, no more than a quarter of an inch long, dressed in suits of glossy black; but as they carry a film of air spread over the underside of their bodies, just as the Great Water-beetles do, the little creatures look like silvery bubbles dancing in the water, as they dart backwards and forwards across the pool. Every now and then one of the little beetles will rise to the surface, turn over on its back, and let its air-bubble burst; then, after resting upside down for a minute or so drinking in the air, down it plunges below again, taking a newly formed air-bubble along with it.

The Small Water-beetle also makes a little cocoon to hold her eggs, but she does not add a little mast to it as the Great Water-beetle

does. If we visit the pools in April, and again about the end of August, we shall most likely find numbers of these tiny, white, silken cases fastened to the weeds or floating on the top of the water.

The grubs which come from the eggs in the cocoons are quaint little beings, with large heads and great big jaws. They seem always to be in a state of great excitement, and wriggle about and snap their jaws at every tiny creature that moves in the water. These little grubs are generally found in quite shallow pools, where they can easily push their tails above the water, for, like the grubs of the larger beetles, the little things breathe through their tails. If they happen to tumble into deep water they hang from the surface, head downwards, drinking in the air from a little cup at the end of their tails all the time. And while they hang suspended in the water they wriggle and twist and bend themselves this way and that way, trying to catch other wee water folk as they go floating by.

At other times the grubs of the Small Water-beetle may be seen crawling about the bottom of the pool with large air-bubbles on the end of their tails ; but if the water should be too

deep the little things have great difficulty in coming up to the surface to breathe; then, in spite of being Water insects, as soon as their air-bubbles become exhausted these funny little grubs will drown.

CHAPTER VI

THE DRAGON OF THE POOL

IF we visit a pool or a rippling stream on a hot summer's day, we are sure to find many little insect folk flitting about, rejoicing in the warmth and brightness of the sun. Gay butterflies and dainty little moths come down to visit the water's edge, fluttering amongst the flowering rushes, the meadow-sweet, the willow-herb, and all the other water-loving plants that grow together on the banks. Bright little beetles climb about the grasses, and gauzy-winged flies without number dart and whirl about overhead and skim lightly over the surface of the water below.

Of all the bright and graceful insects that haunt the water-side none are more brilliant and splendid than the Dragon-flies. Glorious

creatures they are, with their long glittering bodies, huge shining eyes, and graceful wings.

These beautiful insects are not all alike. Some are dainty creatures with long, slender bodies, hardly thicker than a darning needle, and dusky wings clouded with blue. Some have deep blue wings, others purple; and some have clear, transparent wings that gleam in the sunshine with flashing rainbow tints. Other Dragon-flies have broader bodies and soft brown or yellow wings; and some are great, long fellows glittering in green and gold—but all are handsome insects, delightful to watch as they dart over the water, rising, falling, wheeling and turning with the most wonderful ease and swiftness.

You will only see the Dragon-flies about when the sun is shining; on dull days they hide themselves away. Even a dark cloud passing over the sky will send them all to shelter amongst the reeds and rushes and the bushes near by; and there they rest, so still, that in spite of their bright colours it is difficult to see them, and they will not venture forth until the sun shows his face again.

Wherever there is water you may see some of these bright Dragon-flies, though they are

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not, of course, so plentiful as flies and gnats or even butterflies and moths. They haunt the streams, the pools and the banks of rivers, and the meadows, lanes, and woodland glades near by.

Some people are afraid of Dragon-flies, and country folk often call them "Horse-stingers." But this is a foolish name to give these lovely insects, as they do not sting horses or anything else. They have no sting, and are really perfectly harmless, although some of the big fellows certainly do look rather alarming, as they swoop through the air ; and I heard of a small boy once, who seeing, for the first time, some great green Dragon-flies darting round a pond, ran home in great excitement, and said he had seen some flying serpents !

But although *we* may call them harmless, the insect folk, if they could speak, would have a very different tale to tell, for these great insects are the dragons of the insect world. They are mighty hunters, and seem to delight in chasing and killing all kinds of helpless insects, even when they are not hungry, for they capture many more than they can possibly need for food. They pounce fiercely upon flies, moths, and butterflies,

seize them, and, without pausing in their flight, bite and tear off the wings and legs of their unfortunate victims.

The Dragon-flies we most often see are the Green Dragon-flies—huge fellows, with green



THE DRAGON OF THE POOL.

and yellow body and clear, gauzy wings. They fly singly, and each one seems to have its own private hunting-ground, over which it hawks backwards and forwards continually. It will haunt the same pond or lane or meadow for weeks together, and often chooses a particular bush or clump of rushes as "home," coming back to it again and again after each hunting expedition, sometimes even clinging

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to the very same leaf every time it returns to rest.

But the Dragon-fly has not always been so bright and graceful. In his youthful days (as is so often the case in the insect world) he was anything but handsome. Indeed, he was a most ugly creature, with a dark brown body shaped something like a cigar, a large flat head, great dull eyes, and a pair of wicked-looking jaws; and instead of passing his time flying about in the sunshine he spent his day in the dim light at the bottom of the pool.

The larva of the Dragon-fly is a clumsy creature; he cannot move about at all quickly or gracefully—though now and again he may dart suddenly forward, in short, quick spurts, by shooting out a jet of water from his tail. He plods along slowly but steadily, twisting his ungainly body over the floor of the pool, or swims lazily through the water by swaying himself from side to side, and he spends hours together clinging to the stems of the water weeds.

But if he is not very nimble, the Dragon of the pool is cunning. He may be slow, but he is sure; and he knows how to catch his dinner

without the trouble of hunting his prey. Tucked away underneath his chin the Dragon has a most extraordinary lip, called a mask, which is a perfect trap for catching unwary insects. It is something like an enormous hand, with a pair of pincers instead of fingers, on the end of a long jointed arm. The arm is hinged, and when the dragon is at rest or prowling about the pond, the mask is folded back beneath him and cannot be seen ; but the moment a heedless little creature passes within reach, out it shoots like a great paw, and the poor little thing finds itself seized by the pincers and carried to the jaws of the hungry monster !

Few creatures are sharp enough to see this terrible dragon as he lurks, motionless, amongst the weeds ; for his dull-brown colouring blends so well with the mud and the plants at the bottom of the pond that while he is still he is almost invisible. So the poor little water folk come gaily swimming by, and do not discover the lurking monster until it is too late.

This strange larva never becomes a resting pupa, or chrysalis, as most insects do, but all the while it lives beneath the water it is

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gradually changing under its ugly husk and getting ready for its wonderful transformation. Several times it casts its skin, and after each moult the larva is slightly altered in appearance. In time, marks like tiny wing cases appear upon its back, showing that under its dull skin the glorious wings are forming, and when these wing marks are seen the larva is called a "nymph," though this seems a strange name to give to such an ugly creature. But although it may alter in appearance it does not alter in ways. It keeps its horrid mask and is still the dragon of the pool, catching and devouring all who come within reach of its terrible pincers.

At last the time draws near when the dragon must leave his watery home. He grows restless, and climbs up the water weeds to have a look round at the world above the pool. Two or three times he may do this, as if he could not quite make up his mind to leave his old home, but at length he takes courage and crawls right out of the water.

Clinging tightly with his legs to the stem of some plant growing near the water's edge, the ugly Dragon rests for a while perfectly still. Then his great dull eyes begin to glow



READY TO FIGHT: GRUBS OF BROWN WATER-BEETLE

[See Page 32.]



A GROUP OF DRAGON-FLIES

with light and his dingy skin cracks down the back. Gradually the shoulders, the head, and the legs of the insect are pushed through the crack, and then with a final effort the long hind body is drawn from the old skin and the Dragon-fly is free.

But he looks very unlike the gorgeous, glittering insect we expected to see. Pale, limp, and crumpled, he hangs from the plant almost as if he were dead.

But wait! As he rests the Dragon-fly is gaining strength. As the sun shines upon him, the crumpled wings unfold, all the beautiful colours gradually appear, and soon he clings to the plant in all his splendour. For a little while longer he rests, while his lovely wings grow dry and firm. Then, like a flash of light, he darts aloft—the Dragon-fly has gone!

“To-day I saw the dragon-fly
Come from the wells where he did lie.

An inner impulse rent the veil
Of his old husk, from head to tail
Came out clear plates of sapphire mail.

He dried his wings: like gauze they grew;
Thro’ crofts and pastures wet with dew
A living flash of light he flew.”

CHAPTER VII

THE "QUICK-WINGED GNAT"

IF we happen to be up with the lark on a fine summer's day, before the sun looks over the edge of the world to say "good morning," and run out in the cool grey dawn, over the field and down the lane, we shall find that we are not the only early risers. Faint rustling sounds in the grass and in the hedge-row tell us that wee, wild beasties are already abroad; sleepy chirps from the tree-tops show that the birds are waking, and soon will all be shouting together their joyous, morning song.

The insect folk too are astir. Down by the pond at the end of the lane a faint, shrill, piping note is heard as the Grey Gnat comes flying down to the water.

"Ping, ping!" she cries, as lightly and daintily she alights upon the water and rests there securely without even wetting her slender feet, which make but the tiniest dimples in the surface-film.

What is the Grey Gnat doing so early in the

morning? She is intent on business. Before the sun is well up she means to lay two or three hundred eggs, so she has no time to lose.

Quickly she proceeds to pop her tiny eggs, one by one, upon the water, carefully glueing them together; and soon she holds between her slender legs a little mass of eggs shaped like a tiny boat. Then, her work done, with a joyous "ping!" she darts up into the air again to spend the rest of the summer's day in merry dancing.

The little egg-raft is left floating on the water. It is water-proof, and so well shaped that it cannot sink. Each tiny egg is pointed at the top and provided at the lower end with a lid, like a little trap-door through which the baby Gnats will escape as soon as they are ready to pop out into the water.

The little egg-raft floats on the pond all day, but early next morning one after another the little lids are pushed open and the wee Gnat babies leave their tiny boat.

These children are not in the least like Mother Gnat, but this does not surprise us, for we know this is the rule in the insect world. At first they are so very small that one can hardly see them at all; but if you could look at these

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Gnat babies through a magnifying glass you would see a number of queer little creatures, with long, slender bodies, very big heads, and

forked tails. They have no legs at all, but round their heads are a number of stiff bristles sticking straight out like whiskers, and with these the funny little insects are continually sweeping the water.



A BABY GNAT.

These odd little Gnat babies spend most of their time hanging by their tails from the

surface-film on the top of the water, all crowded together as close as can be. But if a shadow passes overhead, down they dive below, and begin plunging and wriggling and darting about in the wildest state of excitement. They soon come up again though, tail first, and hang themselves from the top of the water as before.

You may think it sounds strange to say the little creatures *hang* themselves from the water, but this is really exactly what they do. Although they are so small the baby Gnats are heavier than the water, and would sink to the bottom of the pond if they could not fasten themselves to the top in some way. But one branch of the forked tail, with which each little larva is provided, is really a breathing tube ending in five tiny flaps. These flaps can be closed, making a pointed tip to the tube, or opened so that they spread out and form a tiny cup.

When the great gnat comes up to the top of the water, it pushes the pointed tip of its breathing tube through the surface-film and opens the little cup, which at once becomes filled with air, and rests lightly on the surface like a buoy, and supports the little creature as it hangs head downwards in the water. When it dives below the larva closes the flaps, shutting in a bubble of air which it uses for breathing while it stays beneath the surface.

The baby Gnats grow very fast, and if all goes well, and there is plenty of food for them in the pond, in about ten days' time they are full grown. One might well wonder what

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such tiny things can find to eat. They never appear to catch anything, although as they hang upside down from the top of the pond they are always wriggling and twisting about like a lot of little acrobats, and lashing the water with their funny whiskers.

Now really, as they are going through all these antics, the greedy little things are feeding all the time, but the things they eat are much too small for our eyes to see. As they sway and bend about, their lashing whiskers make tiny currents in the water, and sweep the invisible atoms with which the pond is swarming into their tiny mouths. For the children of the Grey Gnat do not live in clear, pure water, but in stagnant ponds and ditches where there is always plenty of food for them to eat.

As they are growing, the Gnat larvæ moult several times, as most young insects do, and each time they wriggle out of their skins they are a little bit bigger than they were before. The last time they go through this performance, not only do they change their skins, but they change themselves too—the larvæ disappear, and in their place are strange-looking objects, with very small

bodies, and what look like very large heads enclosed in a kind of diver's helmet.

I expect that you will guess that the baby Gnats have now turned to pupæ. This is true, but they do not behave in the usual



A BABY GNAT AFTER IT HAS CHANGED
INTO A PUPA.

way. Instead of quietly resting while their final change is taking place, the Gnat pupæ wriggle about just as much as ever. They dive below, plunge about, and paddle themselves along with two little paddles at the end of their tails. They are just as active as ever,

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but they are no longer able to feed ; for their great, big helmets are tightly closed, and it is quite impossible for them to eat anything.

They rise to the top of the water, head first now, instead of tail first, for the young Gnats no longer breathe through their tails. Instead of little breathing cups they have two little trumpet-shaped tubes on the back of their helmets, and these are pushed through the surface-film to take in the air.

And now the time is drawing near when the strange children of the Grey Gnat are to make their last wondrous change. Not only will they change in form, but their lives will be altered too. They must leave the dark pond in which they have passed their early days, and rise like winged fairies into the air and sunshine.

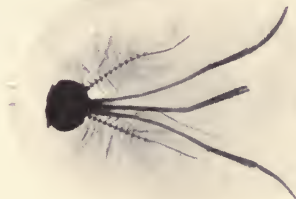
Inside the curious helmet, which each little creature wears, the gauzy wings, the head, and the slender legs of the gnat are growing ; and as soon as the transformation is complete the ugly pupa rises for the last time to the top of the water.

Slowly the helmet is pushed above the surface. The air dries the skin, it cracks, and through the rent the dainty Gnat gradually

pushes its way and stands lightly poised in its old pupa skin :—

"The quick-winged Gnat doth make a boat
Of his old house wherewith to float,
To a new life."

But take care, little Gnat! This is a dangerous adventure. Should a puff of wind



HEAD OF MALE GNAT, SHOWING PLUMED ANTENNÆ
AND HARMLESS TRUNK.

upset the frail boat, you will never rise and dance in the sunshine. No longer are you a water baby, and if you slip you will surely drown, or be snapped up by some prowling monster of the pool.

But if no such sad fate overtakes it, the new Gnat shakes the folds from its wings, rubs

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its face and its legs, and smooths itself carefully all over, and before many minutes have passed it is ready to fly. Then with a flit of its wings and an excited "ping!" it darts



HEAD OF FEMALE GNAT, SHOWING SIMPLE ANTENNÆ
AND PIERCING LANCETS.

aloft to join its brothers and sisters in their merry dance.

The Gnats, as they leave the water are not all alike. Some have beautiful, feathery antennæ, others only simple threads. It is the male Gnats who wear the plumes; they are quite harmless insects, as their mouths are not

formed for biting, and they live on the juices of the flowers.

But their sisters, who have the thread-like antennæ, are not so harmless. They are armed with a set of piercing lancets and a sucking tube, and they are fond of sticking their lancets into your skin and sucking your blood. The Grey Gnat is really a mosquito, and her bite is very painful, but she is not so harmful as her relations who live beyond the seas.

CHAPTER VIII

FLIES AND THEIR WATER BABIES

Not all the baby Gnats that pop out from the little trap-doors in the egg-raft into the water live to become graceful two-winged flies like Mother Gnat. As might be expected, quantities of the tiny things fall victims to the hungry monsters of the pool. Not only do the water beetles and all the ugly grubs that live below the surface snap them up whenever they have the chance, but the larva of a fly, very much like the Gnats themselves, devours the poor things too.

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This cannibal larva is called the "Ghost larva," because it is so thin and transparent that you can see right through it. This is most convenient for the Ghost larva, as the tiny creatures of the pool often blunder right into the savage thing, never noticing it is there, as it rests quite still suspended in the water.

It is a most peculiar-looking "ghost." Its shadowy body is long and thin and measures about two-thirds of an inch from head to tail. It has a very large head, two great bulging eyes, a beak like a parrot's, and jaws like a pair of skinny hands with four or five crooked finger-like teeth, ready to clutch all tiny creatures that come within reach; and to make matters worse, this strange insect has a most extraordinary pair of antennæ ending in bunches of stiff bristles, which curve downward in front of its head and can be used to seize and hold its prey. Altogether the Ghost larva is a regular nightmare sort of creature; and really, when this appalling object looms suddenly upon the poor little water folk, I am sure it is enough to frighten them into fits, it is so ugly and terrifying. The Ghost larva has one beauty, however; it is graced with a really splendid tail, which spreads out like an

open feather fan ; but I fear the tiny water creatures who come within reach of the dreadful-looking creature have no time to admire its tail before they are seized and crushed in its horrid jaws.

There are ever so many flies of different kinds always to be seen flitting and buzzing about near the water whenever the days are bright and sunny. Some of them have spent the first part of their lives beneath the water, but others, although they love to haunt the banks of ponds and streams and the low-lying meadows round about, are not true water insects.

The quaint-looking Scorpion-fly loves moist, marshy ground, and is often found near the water-side. But it lives as a larva in the soft mud on the banks of the pools and not below the surface.

You may know the Scorpion-fly by its turned-up tail and its curious beak, which looks like a long, false nose. It is quite a harmless insect, although many people think it stings, as its turned-up tail gives it rather a threatening air. It is a four-winged fly, and its gauzy wings are spotted and splashed with brown.

The great Drone-fly, however, that looks so

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like a bumble bee, was once upon a time a water baby—and a very strange one too.

The larva of the Drone-fly is called the “Rat-tailed maggot.” It is found in quite shallow, muddy pools and ditches. In shape, this strange little larva is very much like a small roly-poly pudding, with a very long, thin tail, and as it is almost as clear and transparent as glass, it is not at all easy to find it. It generally rests or creeps about on the mud at the bottom of the pool, with its funny tail sticking straight up, so that the tip, through which it breathes, is just above the water.

It is the most surprising tail in the world; it consists of two tubes, fitting one within the other like a telescope, and it alters in length according to the depth of the pool in which the little Rat-tailed maggot is living. If the pool is two inches deep the tail will be two inches long—a most astonishing length for a little creature not much more than half an inch long. But should rain fall, and the pool grow deeper, this obliging tail grows longer still to meet the case. Three, four, five, even five and a half inches this remarkable tail will stretch, but then it seems to have reached its

limit, for if the water rises to six inches the little roly-poly larva is forced to float up from the bottom or crawl up the side of the pool, but at all costs it continues to keep the end of its tail in the air !

Resting on the alder-trees on the banks of ponds and slowly moving streams we may often see quantities of little Alder-flies. They are dark-coloured flies, with four long brownish wings and humped backs, - and in some parts of the country people call them "Hump-backed flies."



THE ALDER FLY.

In spite of their strong wings the Alder-flies are very poor fliers, and if you try to catch them will often *run* away instead of taking wing.

The Mother Alder-fly puts her tiny stone-coloured eggs in little clusters on the grass and rushes, or sometimes on stones near the water's edge, and directly the larvæ are hatched they wriggle their way down to the water. Mother Alder-fly is not always as thoughtful as she should be, and sometimes carelessly puts her

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eggs some little distance away from the water ; but no matter how far off they may be, the little creatures start off for the pond the moment they appear in the world. Whether or no they ever take the wrong direction and lose their way I am not able to tell you, but the chances are that most of the funny little things, after much wriggling, find themselves safely in the water.

For a whole year the children of the Alder-fly live in the water. Then they crawl out of the pond and take another overland journey. Sometimes one of these strange little creatures will travel five or six yards, and even climb over a fence before it finds what it considers a safe and comfortable resting-place, which seems a surprisingly long walk for a little insect hardly an inch long to take ; then, when it is tired of wandering, the larva scoops out a little bedroom for itself in the soil, and goes to sleep until it has changed to an Alder-fly.

The pretty, graceful May-flies that appear suddenly in immense swarms, to dance gaily over the ponds and streams for a few short hours, have come floating up from the water where they lived as little crawling creatures



THE NEST OF THE WATER-SPIDER

[See Page 82.]



WATER FLIES: SCORPION FLY, MAY FLY, CADDIS FLY AND
STONE FLY

amongst the stones and weeds. Strange to say, although May-flies take two, or sometimes three years to grow up, their winged life lasts only for a few hours. Although they are called "May-flies" these graceful little insects may be seen at times all through the summer. They rise from the water towards sunset, and spend their short life dancing gaily in the air, often round and round some tall tree—nearly all die before the morning. For although next day, as the sun sinks to rest, May-flies are again seen merrily dancing round the very same tree, they are not the same flies, but a new dancing party that has risen from the water.

The pretty May-flies go through one more change in their lives than most insects. Directly they quit the water they cast a second, very thin and delicate skin. Quantities of these little over-coats are often seen hanging on the trees and grasses round about the pond, and are sometimes called "May-fly ghosts."

Most water insects like quiet pools best, and are not at all particular about the water being clean. Indeed, many prefer stagnant water, for there they are sure of finding plenty

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to eat. There are others, however, that choose to make their homes in clear, running water; and on the borders of a merry bubbling brook, where blue forget-me-not and cool green water-cress are growing we may often see the slow-winged Stone-flies.

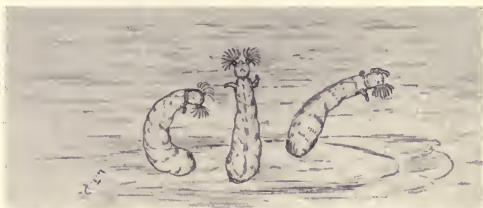
They are heavy insects, with four brown gauzy wings and two curious little tails behind. They fly low over the ground, whizzing along almost in a straight line, and it is quite easy to catch them.

The larvæ of the Stone-flies are often called "Creepers;" they live in the brook, and if you lift a fair-sized stone from the water most likely two or three little creatures, like small, dusky shrimps, will scuttle from beneath it, and try to hide themselves under another stone as quickly as they can.

The Creeper does not change to a resting pupa, but when it is ready for its transformation leaves the water and fixes itself by its hooked feet to a stone. Its old skin begins to swell, then suddenly it splits down the back and out comes the fly. Sometimes in early summer you may see what seems to be a number of Stone-fly Creepers resting on the stones that border the brook; but when you touch them you will

find they are only the dry, empty skins from which the flies have escaped.

The larvæ of the Sand-flies like briskly running water, and are often found in little rivulets or streams flowing down a hill-side. The flies



THE CHILDREN OF THE SAND-FLY.

often cluster together in numbers on the trees and bushes by the water-side. They are delicate little flies, with two gauzy wings, rather humped backs, and large eyes.

The larva of the Sand-fly is a quaint little object, looking something like an absurd little doll dressed in a long, tightly-fitting black frock. On each side of its tiny head it has a fan-shaped tuft of fine hairs, and just below its head two tiny legs stand stiffly out like stumpy little arms. This funny little creature creeps about the plants under the water like

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a looper caterpillar; or, fixed to the under surface of a leaf by a sucker on its tail, it hangs head downwards, sweeping the particles of food which float by in the swiftly moving stream into its tiny mouth with its waving hairs.

If the little creature is startled it instantly drops from its leaf, but it is not, as one might suppose, swept away by the current. It has let itself down by a silken rope, just as a caterpillar swings down from a tree, and as soon as it has recovered from its alarm, it will proceed to haul itself up again. It can spin threads almost as well as a spider can, and makes a perfect network round about, stretching from leaf to leaf. Along these threads it travels at lightning speed when it wishes to change its position.

Before changing to a pupa the larva does not leave the water, but weaves a silken cocoon which it fixes to the stem of a water weed like a tiny pocket. At first the pocket is closed, but as soon as the larva has cast its skin and become a pupa it pushes it open at the top, and a strange-looking head, still adorned with tufts of hair, appears over the top. The pupa holds fast to the inside of its pocket by a

number of hooks on the lower end of its pupa case, and waves its hairs about in the water to draw a current of air within.

Before very long the Sand-fly is ready to leave its prison. But what is it to do? How can a little gauzy-winged fly escape through the rushing water? Surely it will be swept away and never reach the air and sunshine.

Well, a short time before the fly is ready to come forth the pupa case swells with air until it is almost as round as a ball. Then the skin splits and out comes a silvery bubble of air that rises swiftly to the top of the water. Directly it reaches the air the bubble bursts—vanishes like a fairy coach—and the dainty little fly which was within steps lightly on the surface of the stream.

Did ever fairy Prince ride in a more wonderful coach than this little crystal globe, which carries the fly in safety to the sunshine, up through the rushing water?

CHAPTER IX

THE WISE CADDIS-WORM

“Three wise old men were they, were they,
Who went for a walk on a summer’s day ;
One carried a gun which did nothing but snap ;
One had a club and a cricket cap.
But the wisest one to keep off the heat
Wore an ulster down to his feet.”

THE water world is really such a dangerous place for all tiny, soft, little insect folk that when they go for a swim or a walk, like the three wise old men, they certainly do need something to protect them from all the dragons, the tyrants, and the ogres of the pool.

To be sure they do not carry guns and clubs to ward off the attacks of ferocious creatures, but many tiny, defenceless insects have all sorts of tricks and dodges by which they try to scare away or outwit their foes. Some shoot jets of horrid stuff in the faces of their enemies ; others have long, waving tails and bristles with which they lash the water, hoping in this way to startle prowling monsters and make their escape in the confusion ; but

the "wisest one," perhaps, is the funny old Caddis-worm; for like the man who "wore an ulster down to his feet," it clothes itself from top to toe in a large, trailing garment, into which when danger threatens it disappears altogether, like—

The man in the ulster, who smiled as he cried,
"Under my coat *I* mean to hide. . . ."

The Caddis-worms are really the funniest sight as they amble and shuffle along at the bottom of the pool, dragging their long, clumsy-looking cases behind them. There is very little indeed of the insect itself to be seen, as the cautious Caddis never allows more than its head and shoulders to appear unclothed; the rest of its long, thin body is always completely hidden away in its extraordinary garment. Its case is often so large and heavy that if it lived on dry land the Caddis would not be able to move at all, but under the water it is, of course, much easier to drag about a heavy load, and the insect can creep slowly along the floor of the pool or even climb up and down the weeds without much difficulty. As it ambles along on its six thin little legs the Caddis keeps a sharp look-out

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in all directions, ready to pop right back in its case at the first sign of danger ; but when all is safe once more, slowly and cautiously

the little head and tiny legs are pushed out again and the funny old Caddis goes marching on its way.

The Caddis has good reason for being so cautious, for although it has a hard red head and its shoulders are protected by a tough, horny skin of



CURIOUS CASES MADE BY CADDIS-
WORMS.

the same colour, the rest of its long body is so soft and white and tender that it would be a tempting morsel for a hungry water creature. When out of its case, the Caddis looks very much like a small caterpillar, only it has no cushion feet, and instead of a pair of claspers it has two little hooks at the end of its tail.

The Caddis-worms do not all dress alike. They pay no regard to fashion, but each Caddis family has its own particular style of dress. They are most particular, too, about the material they use. One will have nothing but leaves, or bits of leaves, arranged round and round to make a kind of long, frilly skirt, (very much like the frocks that the little Basket-worms, which crawl about the trees and grass on dry land, wear). Another prefers a plain, neat garment, and is always dressed in a long straight sort of coat, made of little pieces of grass or rushes carefully joined and bound together with silken threads, which the Caddis-worms spin from their mouths just as caterpillars do.

Some of these funny creatures surround themselves with little bundles of twigs, straws, or chips of wood; others trim their frocks with tiny shells and stones, sometimes they will even stick tiny live snail shells on their curious garments without in the least considering the feelings of the poor little snails inside! And while some Caddis-worms make really beautiful little cases of sand, shell, seeds, or stones, all neatly and carefully fixed together with fine silky threads, others are

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most untidy creatures and just stick all sorts of odds and ends together in a higgledy-piggledy fashion, so that they look as if they were dressed in rags and tatters. Even a tidy Caddis, after it has taken no end of trouble to join its leaves, or pieces of grass, or whatever it is using, neatly together, will suddenly add a long straggling wisp of straw or a broken twig to its costume and spoil the whole thing! One never knows what a Caddis is going to do next.

But whatever their cases are made of, and whether they be neat or untidy, they are always lined with a finely woven, silken tube, which makes a beautifully soft and cosy undergarment for the tender body of the little Caddis-worm.

It is not the least use trying to pull a Caddis out of its case, for it clings tightly to the silken lining with the little hooks on its tail and refuses to budge. The obstinate little thing would rather allow itself to be pulled in two than pulled out of its case. Of course the Caddis outgrows its strange garment several times while it lives under the water, and then it will either add another frill or a fresh row or two of stones, as the case

may be, or decide to make an entirely new costume.

The case has always an opening at both ends, in order to allow a constant stream of water to flow through it; for a Caddis does not come up to the surface to breathe as so



A CADDIS-WORM TAKING A WALK.

many water insects do, but gets its supply of oxygen from the water, by means of feathery gills down its sides.

The Caddis-worms live chiefly upon the weeds growing beneath the water, but now and again some of these funny insects grow tired of having nothing but vegetable for every meal, and vary their food by catching and eating a few of the tiny water-dwellers.

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As a rule, however, they are quiet, peaceful folk, and do not interfere with their neighbours, though they vary in their ways just as other folk do ; there is even a Caddis living in the streams of North America that spreads a snare to catch its dinner very much as a spider does. The cunning insect weaves a large, strong net round the edge of its tube and supports it at each side with a few little twigs to keep it well spread out. All sorts of tiny water creatures come floating down the stream and are caught in this clever fishing-net, and so fall victims to the wily Caddis, which lurks with its head at the end of its tube ready to seize its prey.

When a Caddis is about to change to a pupa it first retires within its case and carefully closes both ends with a loosely woven cap of silk, as it does not wish to be disturbed by prying creatures while it is taking its rest. Sometimes a Caddis strengthens the cap with a few small stones or other odds and ends ; but it is always careful to arrange matters so that a stream of water can flow through the case, for although the pupa does not eat, it still continues to breathe.

As soon as the Caddis has safely shut itself

up it casts its skin, and there in its place is a strange-looking white pupa, with two black eyes, a parrot's beak, a pair of antennæ, and six slender legs which for the present lie limply pressed against its sides.

This strange pupa lies quietly in its old case at the bottom of the pool while its wondrous transformation is taking place. Soon instead of a Caddis-worm it will be a Caddis-fly—a pretty, greyish fly that looks very much like a moth. Its wings are large, and when closed, meet over the insect's back like a little slanting roof.

But before it can become a fly the Caddis must leave the water, and we left it lying as a pupa at the bottom of the pond, shut up in its old case. How is it going to get out ?

Well, as soon as it is quite ready to make its last change the pupa breaks open the end of its case with its funny parrot's beak, and pushes its way out into the water. Directly it is free we see the use of its six thin legs, for this pupa is able to swim and run about quite nimbly. But it must not stay long in the water ; that would not be at all a safe place for such a soft, defenceless creature ; so the pupa swims a little way on its back, and

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then climbs up the stem of a plant until it is above the surface of the water. When safely in the air the pupa splits its skin, and soon the little Caddis-fly is flitting away.

CHAPTER X

WATER HOUSES

A CATERPILLAR is about the last insect one would expect to find living beneath the water. But then, the insect folk are so astonishing, and often so contradictory in their ways, that the more we learn about them the less surprised we are at anything, however peculiar, that they may do.

The Caterpillar that chooses to make its home in the water, is the larva of the China Marks Moth, a small, prettily marked moth that flies over marshlands, and round about ponds and lakes. The Mother Moth lays her eggs on the under-side of the leaves of water plants, and when the little Caterpillars emerge they at once take like ducks to the water.

Most Caterpillars would be drowned if they suddenly found themselves in a pond, but the

China Marks Caterpillars are perfectly happy and comfortable. Each makes for itself a nice little home by first cutting off an oval-shaped piece from a leaf and fastening it with silk to the underside of another leaf, and inside this it lives contentedly. The Caterpillar's house is always full of fresh air, for the little owner breathes in true insect fashion through breathing pores (or spiracles) down each side of its body.

When it is hungry the Caterpillar pushes its head out of doors and nibbles the plants round about. The door is an opening with an elastic edge which fits tightly round the insect's shoulders while it is feeding ; so the air within is not displaced, and, strange to say, although this Caterpillar lives under water no water ever gets into its little house.

When cold weather comes, and the water plants wither, this queer little Caterpillar goes to sleep. In the spring it wakes up again and sets to work to make a new house, this time with two pieces of leaf, fastened together at the edges with silk, so that it can move about in the water in search of fresh food. It is often found in ponds where water lilies grow, for it seems to prefer the leaves of the water-

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lily to any other plant, both for food and for making its little floating house.

When ready to change to a pupa the caterpillar climbs up the stem of a tall plant, and makes a little cocoon above the surface of the water, and in due time the little Moth comes forth and flutters away.

It is strange how much these little water folk differ one from another in their habits and customs. There are hardly two that are exactly alike in every way. The Caterpillar floats in its airy, water-tight house; the funny old Caddis totters along, dragging its heavy case; the great Water-beetles swim and dive in the water; many insects creep and crawl about the weed below; while the Water Spring-tail hops and skips, and the Pond-skaters skate upon the surface of the pond.

Some insects draw their supply of oxygen directly from the water, others must come to the surface to breathe. Some carry bubbles of air on the end of their tails. Some carry a private store spread over their chests, or in water-tight tanks on their back, and so on. Some put their heads out of the water to breathe, others their tails, and others lie on their backs on the surface.

Water-beetles leave the water and rest in the ground or in silken cocoons while they are changing to perfect insects, then they return to their old house once more. The restless Dragon-fly comes from the pool and wastes no time in turning to a lovely winged insect. The Gnat floats to freedom on its little raft. The Sand-fly and the Caddis-fly both rest beneath the water ; yet while one is carried up through the water in a crystal ball of air, the other climbs up the rushes with its funny long legs, and does not split its skin until it is high and dry.

Yet surely there is one way, you think, in which the flies that come from the ponds and streams must all be alike. When once they have donned their gauzy wings they can never return to the water again.

Not so. There are a few flies that creep down the stems of the water weeds to lay their eggs beneath the water. And "*curiouser and curiouser*," as Alice said when she wandered through Wonderland, there is actually a wee four-winged fly which chooses to *live* in the water. There it creeps about on the weeds below the surface, or swims here and there in a jerky way, using its tiny wings as oars !

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Before we leave the pond we must not forget to notice the Water-spider. It is not a true insect, as you can tell at once if you count its legs—for a spider has eight instead of six. It differs from the insect folk in several other ways besides, but you will learn all about this in the "Spider Book."

But the Water-spider is such an interesting little creature, we cannot pass her by.

She is not very much to look at as she runs briskly about over the broad, flat leaves which lie on the surface of the pond—just an ordinary little brownish spider, about half an inch long, with black, hairy legs. But wait until she dives beneath the water. Gone is the dull little spider; in her place we see a beautiful creature clad in a dazzling silver robe! The magic touch of the water has changed the dowdy spider as the fairy Godmother's wand changed Cinderella before she went to the ball!

This magic change is caused by quantities of tiny air bubbles imprisoned in the soft, fine hairs with which the spider is clothed. So as she journeys through the water she is surrounded with a film of air.

What does the Spider do beneath the

water? She appears to be very busy indeed down amongst the water weeds. She moves quickly backwards and forwards, and here and there she fastens a strong fine thread to the weeds. Then in the centre of this foundation she begins to spin a fine silky web.

The Spider is not wearing a snare to catch the water insects. No, she is making a nice little house in which she may dwell beneath the water. To be sure, she is very fond of insects for dinner, but she does not want them to come blundering into her web and spoiling her house.

At first the web does not appear very shapely—it looks only like a little shadowy bundle in the water. But as soon as she has finished her weaving the Spider ascends to the surface, and, climbing up a rope she has thoughtfully fastened to a floating weed, she puts the end of her hairy body above the water, and with a quick little flick she catches a bubble of air; then down she dives again, holding the bubble between her hind legs, and pops it into her house.

Ever so many times the Spider journeys to the top of the water, and each time she returns with another bubble for her house. At last

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the shadowy web is quite filled with air and stands out in the water like a silver thimble.

In this beautiful little nest the Spider passes her time while she is under the water, coming out now and then to catch something to eat when she feels hungry. In the winter she stays at home altogether, and takes a long nap; but as soon as warm days return the Spider is busy again; she makes another nest and fastens within it a silken cocoon filled with eggs.

When the little spiderkins leave the nest they are too small to spin webs and make houses, so each one chooses a tiny, empty shell, that once belonged to a Water-snail, and fills it with air; and in this little boat it floats about until it is old enough to make a silver thimble.

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